38910

Patent Application

of

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For

METHOD AND APPARATUS FOR PROVIDING PREPAID MUSIC CARD FOR DECIPHERING RECORDED BROADCAST AUDIO SIGNALS

Cross-Reference to Related Applications

Related subject matter is disclosed and claimed in co-pending U.S. Patent Application Serial No. 09/263,207 , filed by Stelios Patsiokas on March 5, 1999; and in co-pending U.S. Patent Application Serial No. 09/310,352, filed by Anh Nguyen et al on May 12, 1999; both of said applications being expressly incorporated herein by reference.

Field of the Invention

The invention relates to a method and apparatus for deciphering recorded digital audio broadcast signals. More specifically, the invention relates to a prepaid smart card for insertion into a playing and recording device for deciphering recorded encrypted audio signals which a user desires to hear, deducting monetary credits from the prepaid smart card, deciphering the encrypted digital audio signal and recording the deciphered digital audio signal.

Background of the Invention

Scrambling and encryption of broadcast signals to prevent unauthorized listening or viewing of audio and video programs is a well known technique in the art of pay-per-view services. In the case of cable or satellite television transmissions, a set-top box is programmed by the broadcasting service to descramble or decipher channels which are subscribed to, and paid for, by a user. When a user desires to access a pay-per-view service, such as a pay-per-view movie, one method requires the user to call up the ~~servic~~ service provider to order the movie. The user receives an authorization code to enter manually into the set-top box. If the user waits until the start of the movie before calling for an authorization code, the user will miss the beginning of the movie.

Smart cards, also known as prepaid transaction cards, have been used in various business sectors to prepay for services, such as long distance telephone service, photocopy machines, and train transportation. A card equipped with a magnetic or electronic recording medium, such a magnetic strip or a memory chip, is sold to a user. Monetary value is encoded on the cards' recording medium, the amount of which is determined by the user within limits set by the service provider. For example, when a smart card is used for daily commuting on a local rail system, the maximum monetary value which can be placed on the card may be limited by the amount of currency that will be accepted by the card vending machine. The amount that a smart card can have at any one time may also be limited for security reasons, since the card is not limited to use by any one person and is simply a means to convert legal tender to a more convenient electronic form.

Electronic transfer of digital information to a user is described in U.S. Patent No. 5,845,262. A user selects information to be retrieved, and inserts a prepaid card into an information vending machine. The vending machine deducts an amount needed to pay for the selected information, and records the purchased information onto a recording medium, which can be the smart card, an IC card, a floppy disk, and the like. The information is transferred to the user in a readily readable format.

Dissemination and sale of a digital product using personal computers is described in U.S. Patent No. 5,898,777. An encrypted digital product, such as software, is downloaded to a user computer. A purchaser triggers a purchase, using unencrypted purchasing software provided with the encrypted product, between the personal computer and a bank network. The merchant receives credit for the purchase

from the banking network, and the encrypted product is deciphered by the purchasing program. In this manner the merchant does not have to deal with giving the user cumbersome decipher keys to enter manually.

Summary of the Invention

In accordance with the present invention, an apparatus is provided for the deduction of monetary credits from a smart card and the deciphering of an encrypted digital audio recording.

Sub B1 In accordance with another aspect of the present invention, a method is provided whereby a user can record an encrypted digital audio broadcast onto a recording medium, then insert a smart cart having monetary value encoded thereon into a player, in order to begin the deciphering process. The player deducts the appropriate number of credits or monetary amount from the smart card, and proceeds to decipher the encrypted recording. As the recording is deciphered, the player records the deciphered digital audio onto a second recording medium.

In another aspect of the invention, the first and second ~~readable/writeable~~ medium are the same. In this manner, following the deduction of the appropriate number of credits or monetary amount from the smart card, a portion of the encrypted recording is deciphered and stored in a buffer. The deciphering process is interrupted while the deciphered portion in the buffer is transferred and recorded onto the recording medium.

In another aspect of the invention, the key to decipher the recording is contained in memory in the player. The key can only be activated when the appropriate number of credits or monetary amount from the smart card has been deducted.

In another aspect of the invention, the smart card can be purchased from a vendor or vending machine, and the monetary value of the smart cart can be adjusted up or down for the user by the vendor or vending machine. An automatic teller machine can be used as a vending machine where a user can add monetary value to the smart card.

Brief Description of the Drawings

The various aspects, advantages and novel features of the present invention will be more readily comprehended from the following detailed description when read in conjunction with the appended drawings, in which:

Fig. 1 is a block diagram of a digital audio broadcast receiver connected to a player/recorder equipped with a smart card reader in accordance with an embodiment of the present invention;

Fig. 2 is a flow chart depicting a sequence of operations for storing digital broadcast signal data in a memory and onto a recording medium;

Fig. 3 is a flow chart depicting a sequence of operations for user payment and deciphering of data stored on the recording medium;

Fig. 4 illustrates a smart card for use in the present invention; and

Fig. 5 illustrates an alternative smart card for use in the present invention.

Throughout the drawing figures, like reference numerals will be understood to refer to like parts and components.

Detailed Description of the Preferred Embodiments

Fig. 1 depicts a combined receiver, recorder and player system 10 constructed in accordance with the present invention. The system 10 comprises a receiver 12 and a player/recorder 14.

The receiver 12 is preferably an S-band receiver which receives digital audio broadcast signals from a satellite via an antenna 20. The receiver 12 can also receive S-band signals from a terrestrial source when the satellite signals are not available. The receiver unit 12 comprises a radio frequency (RF) front-end receiver 18 for receiving and demodulating the signals received via an S-band antenna 20 for output via the A/D and audio decoder system 16. It will be understood that the output of the front-end receiver 18 is a digital audio signal (which may or may not be encrypted) and that the A/D and audio decoder system 16 includes suitable digital-to-analog conversion circuitry for producing an analog audio output signal for output to speaker 17.

The receiver 12 is provided with a processor 22 having a memory device 24. The memory device 24 can be used to store the receiver identification and a decipher key 26 as required. When an S-band digital audio signal 28 is received at the receiver 12, the processor 22 determines whether the signal 28 is encrypted. If the signal 28 is

encrypted, the processor 22 calls up the key 26 from receiver memory 24 and causes the front-end receiver 18 to decipher the RF signals prior to sending the signals to the A/D and audio decoder system 16.

The receiver 12 also sends the demodulated but undeciphered digital audio signal to the player/recorder device 14 and stores the signal in a player/recorder memory buffer 30. The amount of signal that can be stored in the buffer 30 is dependent upon the size of the buffer 30. In the preferred embodiment, approximately two minutes of audio can be stored in the buffer 30 before it is full and must be emptied.

The player/recorder 14 is provided with a processor 32 which is connected to a memory 31, a record button 34, a play button 36, a first readable/writeable recording medium 38 a second readable/writeable recording medium 39 and a smart card reader 42. A duplicate key 26 is stored in the memory 31.

With reference to the flowcharts in Figs. 2 – 3, and by way of illustrative example, a user can record an encrypted digital audio signal 28 onto a readable/writeable recording medium 38 for later playback. The recording medium 38 can be any recording medium suitable for digital recording, such as a compact disc, a mini disc an optical disc or a digital audio tape.

The process begins at step 50, and proceeds to step 52. At step 52, a user enables the digital audio receiver 12 and the player/recorder 14, which begins recording the received signal into the buffer 30. (The buffer 30 is preferably located in the player/recorder memory 31, as described above, but can alternatively be located in the receiver memory 24.) At step 54, recording of the signal the buffer 30 continues. Next, in step 56, when a user determines that the digital audio signal should be saved onto the recording medium 38, the record button 34 is pressed, and processing continues at step 58.

In step 58, the processor 32 determines if there is enough of the signal stored in the buffer 30 to record the signal from the beginning of a broadcast segment of the signal. A broadcast segment can be, for example, the duration of a song, the portion between commercials, or any other signal duration that can be determined to have a beginning and an end. If the signal stored in the buffer 30 is from the beginning of a broadcast segment, the process continues to step 60 and the player/recorder 14 begins recording the signal onto the readable/writeable storage medium 38 beginning with the beginning of the segment stored in the buffer 30. If there is not enough signal

stored in the buffer 30 to record the broadcast segment of the signal from the beginning, then the process continues to step 62 and the signal is not recorded onto the readable/writeable recording medium 38.

Following recording of the broadcast segment of the signal in step 60, the process continues to step 64. In step 64, it is determined whether the recording medium 38 is full. If the recording medium 38 is full, broadcast segments of the signal can no longer be recorded onto the recording medium 38 and processing ends at step 66. If the recording medium 38 is not full, the process returns to step 56.

At step 62, the signal continues to be recorded into the buffer 30. Next, in step 68, it is determined whether the buffer 30 is full. If the buffer 30 is full, the process continues to step 70. In step 70 the buffer 30 is emptied and the process continues with step 54. If the buffer 30 is not full, the process continues at step 56.

In Fig. 3, the process begins at step 72, and continues to step 74. In step 74, the recording medium 38 is inserted into the player/recorder device 14. It should be understood that the recorder/player device 14 can be two separate units (i.e., one for recording and one for playing) or one combined unit.

Next, in step 76, it is determined whether the recording on the first recording medium 38 is encrypted. If the recording is not encrypted, the process ends at step 78. If the recording on the first recording medium 38 is encrypted, the process continues to step 80. At step 80, the user inserts a smart card 40 having an encoded monetary value into a smart card reader 42. It will be understood that the smart card reader 42 can either be connected to the player/recorder 14 or located within the same physical unit as the player/recorder 14. Next, at step 82, the processor 32 determines if the card 40 has sufficient value to continue the transaction. If the card 40 does not have sufficient value, the user must add value to the card 40 at step 84. After monetary value has been added to the card at step 84, the process returns to step 82.

At step 86, the player/recorder processor 32 instructs the card reader 42 to deduct an amount from, or recode, the card 40 to pay for deciphering of the recording. After the amount is deducted from the card 40, the process continues at step 88. At step 88, the player/recorder processor 32 retrieves the decipher key 26 and deciphers the recording on the recording medium 38.

Next, in step 90, the deciphered information is recorded onto the second recording medium 39, and the process ends at step 78.

Alternatively, the first recording medium 38 and the second recording medium 39 can be the same. In step 88, the player/recorder processor 32 deciphers a portion of the encrypted recording on the recording medium 38 and transfers the deciphered portion to buffer 30. At step 90, the player /recorder 14 pauses to change from read mode to recording mode and records the deciphered portion in the buffer 30 onto the first recording medium 38. This process repeats until the entire encrypted recording is deciphered and the deciphered version is recorded onto the first recording medium 38.

Figs. 4 and 5 illustrate two possible versions of a magnetically-encoded debit card or smart card which may be used in the smart card reader 42. In Fig. 4, the smart card 40 contains a magnetic strip 44 which is encoded with a prepaid monetary amount that can be used to purchase songs or other audio segments. When the prepaid amount is used up, the user must either recharge the card by adding more value to it, or obtain a new card.

Fig. 5 illustrates a modified smart card 40' which contains a magnetic strip 44' similar to that shown in Fig. 4. In the case of Fig. 5, however, the magnetic strip 44' is encoded not only with a prepaid amount but also a decipher key that can be used by the player/recorder processor 32 to decipher encrypted recordings.

Using the method described above, a user is provided with a smart card 40 having some encoded monetary value. Music received by the receiver 12 is continuously recorded into the buffer 30. While listening to music received by the digital audio receiver 12, the user decides that he or she wants to record a song currently being heard onto a recording medium 38, such as a compact disc. The user then presses the record button 34 and the player 14 determines whether the beginning of the song or audio segment is still in the buffer 30. If the beginning of the desired song is no longer resident in the buffer 30, then the player/recorder 14 will not record the song onto the recording medium 38. If the beginning of the song is still resident in the buffer 30, then the player/recorder 14 will record the portion of the song stored in the buffer 30 and continue to record the signal onto the recording medium until the song is completed.

Data streams carrying digital audio content to the digital audio receiver 12 may be encrypted. In order for a user to hear the audio, the signal ~~28~~ must be deciphered using a key 26. In the above example, the user recorded a song onto a compact disc for repeat listening. However, the song was recorded onto the compact disc in an encrypted format. The user must now pay for the recording of the

deciphered song in order for the player/recorder 14 to decipher the song and record the deciphered song onto a second recording medium 39. To accomplish this task, the user inserts a smart card 40 into a smart card reader 42. The smart card 40 and reader 42 can be any smart card system where a user prepays to have the card 40 encoded with a monetary value, and the reader 42 can read the card 40 and deduct a predetermined amount from the card 40 and recode the card 40 with a new, lesser amount. The total amount deducted from the card 40 can be a function of, for example, the number of songs to be deciphered or the total duration of the recording.

Following the deduction of the predetermined amount from the smart card 40 by the reader 42, the player/recorder 14 is instructed by the processor 32 to decipher and record the deciphered song. The key 26 is retrieved from memory 31 and the song is deciphered and recorded onto the second recording medium 39. After completion of this process, the user can replay the song on the compact disc repeatedly for the user's listening pleasure without ever having to decipher the song on that compact disc again.

As discussed above, the first and second recording medium 38, 39 can be the same. The player/recorder processor 32 retrieves a portion of the encrypted song, deciphers that encrypted portion, and stores the deciphered portion in buffer 30. The player/recorder 14 will then change from a play head to a record head, retrieve the deciphered portion from the buffer 30, and record the deciphered portion onto the first recording medium 38. Accordingly, the first recording medium 38 either has sufficient available recording area to record the deciphered portion, or the recording medium 38 has a reusable recording portion in order to overwrite a portion of the recordable area. Examples of a reusable recording medium are digital audio tape (DAT) and high capacity diskettes.

The card 40 can be disposable or rechargeable. That is, the user can dispose of the card 40 when the prepaid monetary value is depleted, or the card can be reused by adding more monetary value. In order to add more value to the card 40, the user can go to a suitable machine, for example, an automatic teller machine (ATM), and transfer money onto the card 40. Any suitable machine for adding monetary value to a card 40 can be used.

Although the present invention has been described with reference to a preferred embodiment thereof, it will be understood that the invention is not limited to the details thereof. Various modifications and substitutions have been suggested in

the foregoing description, and other will occur to those of ordinary skill in the art. All such substitutions are intended to be embraced within the scope of the invention as defined in the appended claims.